Notice of Allowability	Application No.	Applicant(s)	
	09/973,786	JACKSON ET AL.	
	Examiner	Art Unit	
	Kandasamy Thangavelu	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *April 17, 2006*.

2. ☒ The allowed claim(s) is/are *19,20,24-28,30,32,33 and 35*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

Introduction

1. This communication is in response to the Applicants' communication dated April 17, 2006. Claims 19, 27, and 32 were amended. Claims 21-23, 29, 31, 34 and 36 were canceled. Claims 19, 20, 24-28, 30, 32-33 and 35 of the application are pending.

Drawings

2. The corrected drawing for Fig. 1 submitted on April 17, 2006 is accepted.

Examiner's Amendment

3. Authorization for this examiner's amendment was given in a telephone conversation by Mr. Gang Luo on May 9, 2006.

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to the applicants, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

4. In the claims:

In amended Claim 19, Lines 23-24,

"state of the multiple actuator-sensor smart matter dynamic control system"

has been changed to

-- state of the system --.

In amended Claim 19, Lines 26-27,

"state of a multiple actuator-sensor smart matter dynamic control system"

has been changed to

-- state of the system --.

In amended Claim 19, Lines 27-28,

"state of a multiple actuator-sensor smart matter dynamic control system"

has been changed to

-- state of the system --.

In amended Claim 27, Line 9,

"measuring actual performance"

has been changed to

-- means for measuring actual performance --.

In amended Claim 30, Lines 2-3,

"state of the multiple actuator-sensor smart matter dynamic control system"

has been changed to

-- state of the system --.

In amended Claim 30, Line 5,

"state of a multiple actuator-sensor smart matter dynamic control system"

has been changed to

-- state of the system --.

In amended Claim 30, Lines 6-7,

"state of a multiple actuator-sensor smart matter dynamic control system"

has been changed to

-- state of the system --.

In amended Claim 35, Lines 2-3,

"state of the multiple actuator-sensor smart matter dynamic control system"

has been changed to

-- state of the system --.

In amended Claim 35, Line 5,

"state of a multiple actuator-sensor smart matter dynamic control system"

has been changed to

-- state of the system --.

In amended Claim 35, Lines 6-7,

"state of a multiple actuator-sensor smart matter dynamic control system"

has been changed to

-- state of the system --.

Reasons for Allowance

5. Claims 19, 20, 24-28, 30, 32-33 and 35 of the application are allowed over prior art of record.

6. The following is an Examiner's statement of reasons for the indication of allowable subject matter:

The closest prior art of record shows:

(1) tuning control parameters in the control of manufacturing equipment and robotic systems; the system includes sensors that measure data that accurately characterizes the behavior of the component, a processor that generates a mathematical model of the relationship and a controller that dictates the component motion; information regarding the number and placement of sensors and actuators and desired control behavior is input to the model of the system; the actuators and sensors are collocated to enforce adaptive control; unknown plant dynamics and unforeseen disturbances to the system can significantly alter the actual results obtained by active control; the control system predicts the system performance and tunes itself to maximize system performance; the behavior of the system is estimated by an internal behavior model; the system is capable of estimating an updated behavior model; the system uses adaptive control techniques to compute control gains adaptively from measurement errors (**Jacques,** U.S. Patent application 2003/0028266);

(2) a system and method for adaptively designing self-tuning controllers for process control systems; a candidate process model is defined by a predetermined limited set of models;

each of the models is characterized by a plurality of parameters; for each model, each of the parameters has a respective value that is selected from a set of predetermined initialization values; evaluation of each model includes computation of a model squared error and calculation of a norm from the model squared error; the norm value is assigned to each parameter; the controller uses a process model that is a weighted sum of models; each model in the set generates a prediction of the process output and the corresponding weight is adjusted as a simple function of the prediction error; an adaptive parameter value is calculated for each parameter; the adaptive parameter value is a weighed average of the initialization values assigned to the respective parameters (**Wojsznis et al.,** U.S. Patent 6,577,908); and

(3) weight identification method for determining the weights assigned to a plurality of models in a feedback control system; the method identifies a first weight assigned individually to a plurality of models; based on the first weight assigned to one of the plurality of models, a second weight is assigned to at least one model other than the one of the plurality of models; the second weight assigned to at least one model may decrease if the first weight assigned to one of the models is increased; if the number of models is two, the first weight θ_1 of one of the two models and the second weight θ_2 of the other model may have a relationship $\theta_1 = 1 - \theta_2$; (**Suzuki et al.,** U.S. Patent 6,807,448).

None of these references taken either alone or in combination with the prior art of record discloses in a system using multiple smart matter distributed dynamic controllers, each controller comprising one or more actuator-sensor pairs, a method for dynamic control of the system, specifically including:

(Claim 19) "adjusting the weights of at least two control system models based on their prediction errors relative to the prediction errors of other models wherein adjusting the weights of at least two control system models includes increasing a weight of at least one control system model in the plurality of control system models relative to a weight of at least one other model;

wherein adjusting the weight of each control system model includes defining a fraction a_i of a weight w_i, of an i^{th} model, where $0 < a_i < 1$, which will be adjusted for the next time interval,

the method further comprising assigning a new weight w_i^{new} for the i^{th} model according to the formula

$$w_i^{new} = (1 - a_i)\ w_i^{old} + a_i\ [(\ 1/\ (e_i^2 + \sigma^2))\ /\ (\Sigma_{j=1}^{N}(\ 1/\ (e_j^2 + \sigma^2)))],$$

where w_i^{old} is a previous weight for the i^{th} model, e_j is a prediction error of the i^{th} model, and σ^2 is a noise variance of the multiple actuator-sensor smart matter dynamic control system".

None of these references taken either alone or in combination with the prior art of record discloses smart matter distributed dynamic controllers for a system, specifically including:

(Claim 27) "means for adjusting the weights of at least two control system models based on their prediction errors relative to the prediction errors of other models wherein adjusting the weights of at least two control system models includes increasing a weight of at least one control system model in the plurality of control system models relative to a weight of at least one other model;

wherein means for adjusting the weight of each control system model includes means for defining a fraction a_i of a weight w_i, of an i^{th} model, where $0 < a_i < 1$, which will be adjusted for the next time interval,

wherein the means for increasing a weight assigns a new weight w_i^{new} for the i^{th} model according to the formula

$$w_i^{new} = (1 - a_i)\ w_i^{old} + a_i\ [(\ 1/\ (e_i^2 + \sigma^2))\ /\ (\Sigma_{j=1}^{N}(\ 1/\ (e_j^2 + \sigma^2)))],$$

where w_i^{old} is a previous weight for the i^{th} model, e_j is a prediction error of the i^{th} model, and σ^2 is a noise variance of the multiple actuator-sensor smart matter dynamic control system".

None of these references taken either alone or in combination with the prior art of record discloses smart matter distributed dynamic controllers for a system, specifically including:

(Claim 32) "an adjustment circuit for adjusting the weights of at least two control system models based on their prediction errors relative to the prediction errors of other models wherein adjusting the weights of at least two control system models includes increasing a weight of at least one control system model in the plurality of control system models relative to a weight of at least one other model;

wherein adjusting the weight of each control system model includes defining a fraction a_i of a weight w_i, of an i^{th} model, where $0 < a_i < 1$, which will be adjusted for the next time interval,

wherein the weight increasing circuit assigns a new weight w_i^{new} for the i^{th} model according to the formula

$$w_i^{new} = (1 - a_i)\ w_i^{old} + a_i\ [(\ 1/\ (e_i^2 + \sigma^2))\ /\ (\Sigma_{j=1}^{N}(\ 1/\ (e_j^2 + \sigma^2)))],$$

where w_i^{old} is a previous weight for the i^{th} model, e_j is a prediction error of the i^{th} model, and σ^2 is a noise variance of the multiple actuator-sensor smart matter dynamic control system".

7. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Kandasamy Thangavelu whose telephone number is 571-272-3717. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez, can be reached on 571-272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to TC 2100 Group receptionist: 571-272-2100.

K. Thangavelu
Art Unit 2123
May 9, 2006